CHAPTER 1B

LAYOUT AND QUANTITY SURVEYS

1B-01. GENERAL LAYOUT

It is the responsibility of the Government to establish, at the site, base lines and bench marks necessary to completely lay out the work. The contractor is required to utilize these established points to perform the necessary survey to execute his work.

a. Ascertain that the Government—established points have been found, and that they are maintained and preserved by the contractor.

b. Ensure that the contractor utilizes these Government points and establishes additional prints as necessary to have complete control over the layout of his job.

c. See that the contractor*s layout work is accurately performed and that complete notes are maintained.

d. Ensure that adequate stakes and templates are provided and maintained by the contractor, and that they are clearly marked.

e. Continually check the contractor*s lines and grades of work being accomplished.

1B-02. LAYOUT PROCEDURES

a. General

The required order of accuracy of the layout surveys, if not stated in the specifications, must be established at the outset of the work, usually by the Resident Engineer or higher authority. Remember, as a general rule, the layout surveys must be made with sufficient accuracy that the construction which follows can be held within the specified tolerances. For example, if the specifications require a wall to be constructed within ½ -inch of the location shown on the drawings, the work line laid out by the survey party will have to be correctly located within a much smaller margin of accuracy, say 1/8-inch or 1/16-inch, to leave room for normal variations which must be expected in the construction work. On the other hand, the specified tolerances for the surface of a heavy rock fill might be 1-inch above and 6 inches below grade, in which case an error of as much as an inch in the layout would not cause problems.

b. Deviations from Plans

Should it appear necessary or desirable to change the location or dimensions of any part of the work to fit existing work or adjacent work under another contract (in order to take advantage of more favorable terrain or to rectify an error in the drawings or for any other reason) , report the circumstances promptly to your supervisor.

1B.-03. QUANTITY SURVEYS

a. General

The Government is usually responsible for the original and final survey and for the compilation of quantities of work performed or finally in place where estimated quantities are included in the unit price schedule. Quantities of certain materials and equipment are required for installed equipment property records for the owner.

b. Controls

Wherever practicable, cross-section work should be tied into the same horizontal and vertical controls used for the construction layout. If it is found necessary to establish an independent base line and/or bench mark with an assumed elevation, as might be the case when cross-sectioning a borrow area remote from the construction site, these controls must be located so as to preclude the possibility of losing them. Alternatively they must be tied in by careful horizontal and vertical measurements to a sufficient number of safely located reference points to insure that the controls can be re-established in the event of disturbance.

c. Instruments and Equipment

(1) Are all instruments and equipment (used in making measurements) of a type and quality such that they are capable of maintaining the required degree of accuracy?

(2) Have levels and transits been checked before starting work, to ensure they are in adjustment?

(3) Are they checked periodically during the course of the work and readjusted as necessary?

(4) Are adjustments necessary at frequent intervals? This may indicate that an instrument is not in an acceptable condition for the work to be done.

(5) Are tapes and rods checked for accuracy before starting work?

(6) Are tapes and rods checked during the course of the work for damage or wear? Do not permit the use of tapes or rods which have been worn or damaged to such an extent that correction factors must be applied to measurements taken with them.

d. Measuring Procedures

(1) General - Such items as orientation of the cross-section base line, frequency (spacing) of cross-sections and individual shots, accuracy of tape and rod readings for individual shots and required degree of precision in orienting the cross-sections perpendicular to the base line, all depend upon irregularity of the terrain, shape of the excavation, fill, or other volume to be measured, and upon the unit prices of the payment items involved. These standards must be established at the outset of the work, usually by the Resident Engineer or higher authority.

(2) Checking

(a) Is leveling checked by closing on bench marks?

(b) Are distances checked at the end of each cross-section by taping into an auxiliary parallel base line or by comparison with the adjacent cross-section?

(3) Cross-sections

(a) Have specifications been reviewed and list made of all payment items for which surveys will be needed to measure quantities?

(b) Are cross-sections extended far enough to include the "catch points" of excavation and fill slopes, with generous allowances for over-excavation?

(c) Are sufficient intermediate cross-sections being taken to catch abrupt changes in slope of terrain?

(d) Are plans referred to frequently enough to insure that cross-sections are taken where needed to show conditions at changes in alignment and to show shape and grade of work?

(e) Is a chart or marked drawing being maintained to show the relative locations of cross-sections taken, to show the work in progress, and to insure that cross-sections will be taken in advance of the work?

(f) As cross-sections are taken the QA Rep must be alert to all instances where actual conditions differ from those shown on the drawings. Examples: Ground surface higher or lower than indicated; boulders or ledge rock occurring at locations or elevations different from those indicated; evidence of ground water at locations not indicated; underground or overhead utilities not shown on the drawings. Report the existence of any of these conditions promptly to your supervisor. They may indicate future overruns or underruns in contract payment quantities, or troublesome claims by the contractor on account of “differing site conditions.” Early awareness of these conditions gives the Government maximum opportunity to study possible design changes to avoid or minimize extra expense.

(4) Recording

(a) Are all quantity measurements accurately and neatly recorded in an orderly manner in one binder, if possible?

(b) Is the record such that anyone at a later date will be able to readily and understandably re-evaluate or examine all measurements and computations?